Improvements in or relating to rotary-piston machines of the hinged abutment type

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Application number: GB19640050094 19661118
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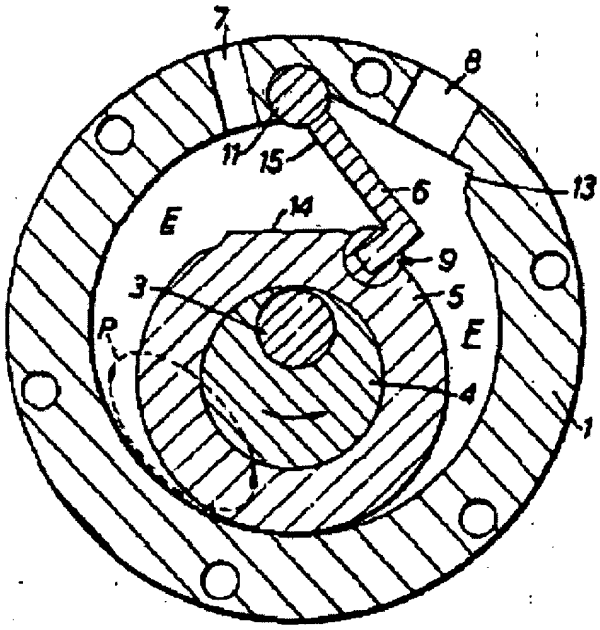
Abstract of **GB1085542**

1,085,542. Rotary fluid-pumps and engines. W.E. STOREY. Nov.18, 1966, No. 50094/64. Heading F1F. A rotary fluid-pump of the hinged-abutment type comprises a sleeve 5 rotatably mounted on an eccentric 4 within a cylinder 1 to which the sleeve is coupled by an abutment plate 6, a pivot pin 11 fixed to one end of the plate being lodged in the cylinder between an inlet port 7 and an outlet port 8 whereas another pivot pin 9 fixed to the opposite end of the plate is situated in the sleeve adjacent a flat surface 14 thereon. A recess 13 in the inner peripheral surface of the cylinder accommodates the plate when the sleeve lies close to said ports. The pivot pin 11 has its ends supported by bearings (12), Fig. 2 (not shown), that are lodged in end plates (2) for the cylinder 1, which plates also support a driving shaft 3 attached to the eccentric 4. In operation, the shaft 3 and the eccentric 4 are rotated in an anti-clockwise direction so that the sleeve 5 travels orbitally within the cylinder 1 and displaces fluid in working spaces E, F on either side of the plate 6 from the port 7 to the port 8. The pump is provided with a non-return valve, preferably on the high-pressure side thereof, said valve being situated on the low-pressure side when the pump is employed as a vacuum pump. The pump may be used as a fluid-driven motor, and may be adapted to operate as either an I. C. engine or a heat engine provided with working fluid by combustion of fuel externally thereof, the engine being in the form of a twin-cylinder unit.

FIG. 1.



1,085,542

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,085,542

Date of Application and filing Complete Specification: November 18, 1966. *No. 50094/64*

Complete Specification Published. October 4, 1967.

Index at Acceptance:—**F1** F (1B4, 2E, 2N1A, 2N1B).

Int. Cl.:—F 01 c.

COMPLETE SPECIFICATION

Improvements in or relating to Rotary-piston Machines of the Hinged Abutment Type

I, WILLIAM EDGAR STOREY, a national of Rhodesia, of 20 Park Road, Suburbs, Bulawayo, Rhodesia, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the followning statement:—

This invention relates to a rotary-piston machine of the hinged abutment type. In such a machine, an eccentrically mounted rotary-piston is operatively connected to a cylinder and is caused to orbit around tne inner circumference of the cylinder.

Generally, in machines of the above type, the connection between the piston and cylinder is a flexible component and is the part of the machine most subjected to wear. In the machine disclosed herein, such connection takes the form of a connecting abutment plate which it not flexible and which is far less subjected to wear with the result that the machine will have a longer life free from breakdown and repair.

According to the invention there is provided a rotary-piston machine of the hinged abutment type, comprising a hollow cylinder having an internal wall and being closed at each of its ends by an end plate, a rotary-piston having a lesser diameter than the internal wall diameter of the cylinder and being eccentrically mounted about the longitudinal axis of the cylinder, a connecting abutment plate extending between said cylinder wall and the piston and further extending substantially the distance between the end plates, and means for hingedly connecting said abutment plate to the piston and to the end plates, the arrangement being such that, during operation, the piston and said abutment plate will provide separation of the space within the cylinder into a first zone communicating with an inlet to the machine and a second zone communicating with an outlet from the machine, the first zone, during operation, increasing in volume while the second zone decreases in volume, and the arrangement further being such that, during operation, fluid introduced into the first zone through the inlet will be received by the second zone from which second zone the fluid will be discharged through the outlet while the first zone increases in volume and the second zone decreases in volume.

Preferably, the piston of the machine disclosed herein comprises an eccentric disposed within a sleeve, the eccentric being capable of freely rotating within the sleeve. The sleeve is free to travel an orbit dictated by the throw of the eccentric without itself rotating with the eccentric.

The present invention will be more readily understood from the following description, given by way of example only, of a rotary-piston machine of the hinged abutment type reference being made to the accompanying drawings in which:—

Figures 1 and 2 are respectively sectional end and side views of such a rotary-piston machine;

Figure 3 is an end view of a connecting abutment plate with its means for hingedly connecting the plate to the piston and cylinder;

Figure 4 is a view taken in the direction of arrow 'A' of Figure 3;

Figure 5 is a view taken in the direction of arrow 'B' of Figure 3, and

Figure 6 shows diagrammatically five positions of the piston and the connecting abutment plate during a cycle of operations.

Turning to Figures 1 and 2, the machine has a hollow cylinder or casing 1 closed at each end by an end plate 2. A bearing (not shown in the drawings) is included in each end plate 2 and these support a shaft 3 cen-

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trally positioned within the casing 1. The shaft 3 is integral with an eccentric 4 freely working in a surrounding sleeve 5 which makes a line of contact with the inner periphery of the casing 1. Between the casing 1 and the sleeve 5 extends a connecting abutment plate 6 which thus divides the working space or chamber of the machine. An inlet port is indicated at 7 and an outlet port is indicated at 8. These ports permit the passage of fluids through the machine.

Connecting the rotary-piston (the term rotary-piston being used to identify the eccentric 4 and sleeve 5 collectively) to the connecting abutment plate 6 is a hinge connection 9 which takes the form of a knuckle joint. This joint comprises a pivot pin 10 secured to the plate 6 (see Figures 3 to 5) and received in a recess of the sleeve 5. The pivot pin 10 is similar in axial length to the plate 6, the cylinder 1 and the piston. Also connected to the plate 6 is a further pivot pin 11 (see Figures 3 to 5) which is received in a recess in the cylinder 1 and which projects beyond the sides of the plate 6 and beyond the end bounderies of the cylinder 1. It is this projection of the pin 11 beyond the end boundaries of the cylinder 1 that provides an essential difference over known constructions and allows the pin 11 to be positively located in bearings housed in the end plates 2 forming the side walls of the cylinder. Such bearings are shown at 12 in Figure 2.

The inner wall of the cylinder 1 is recessed at 13 to accommodate the plate 6 which will hinge into it out of the path of the sleeve 5 each time the line of contact between the sleeve 5 and cylinder 1 passes across the plate 6 during operation of the machine. The sleeve 5 is provided with a flat portion 14 for engagement with the plate 6. It will be appreciated that there is no necessity to complicate the shape of the plate 6 as a simple shape can be accommodated by providing matching recesses in the cylinder and piston. The space within the cylinder which accommodates the pin 11 need provide no bearing surface but only sufficient interference to provide a seal which will restrict the flow of gas or liquid from the high pressure side to the low pressure side of the plate 6.

Instead of providing the sleeve 5 with a flat portion 14, the plate 6 may be provided with a portion concaved on a radius substantially equal to the radius describing the inner peripheral surface of the cylinder for engagement with the sleeve 5.

The throw of the eccentric 4 will cause the sleeve 5 to travel in a circular path within the cylinder 1 and maintain the line of contact with the cylinder 1 during the cycle of operations with the exception of the crossing of the plate 6 when contact will be made between the sleeve 5 and the inner surface of 15 of the plate 6.

Referring to Figure 1, point P is a point on the periphery of the piston directly opposite the hinge connection 9. The dotted line prescribes the travel of the point P during one revolution of the eccentric, i.e. one complete orbit of the piston. The elliptical shape of this path of travel is due to the oscillation of the piston about its own axis as it orbits within the cylinder.

Provided that the high pressure is confined to the chamber bounded by the top side of the plate 6, the thrust on the piston pivot due to this pressure, coupled with the thrust due to the inertia of the moving piston, results in a thrust moving across the full bearing face provided by the recess in the periphery of the piston accommodating the pivot pin 10. The inertia due to the movement of the plate 6 is opposed in one direction by the full bearing face of the hinge connection 9, and in the other direction by the pressure on the plate 6. There is therefore no thrust load towards the open side of the recess locating the pivot pin 10 in the piston.

The operation of the machine as a pump is based on the induction and expulsion of the fluid into and from the volume between the piston and the cylinder 1. Other than when the line of contact between the sleeve 5 and cylinder 1 coincides with the hinge connection 9 between the sleeve 5 and plate 6, this space will be divided into two zones, or spaces, E, F, by the sleeve 5 and the plate 6 and orbiting movement of the piston will progressively enlarge the one space E causing induction of the fluid through the inlet port 7 and diminish the other space F causing expulsion of the fluid through the outlet port 8. Thus, the two spaces E, F are always joining one another as the machine is operated so that movement of the fluid through the machine is continuous.

Referring to Figure 6 which illustrates the operation of the machine, the shaft 3 is rotated to produce anti-clockwise motion of the piston within the cylinder 1 and Figure 6A shows the cycle commencing as the line of contact between the sleeve 5 and the cylinder 1 passes the inlet port 7. The space E is beginning to enlarge with the resulting induction of fluid through the inlet port 7. In Figure 6B, space E has increased to fill approximately half the machine capacity and space F has correspondingly diminished. At the position shown in Figure 6C, the full capacity of the machine is occupied by space E and filled with the fluid induced through the inlet port 7 to the substantial total exclusion of space F. As the cycle continues and the sleeve 5 engages across the plate 6 (see Figures 6D and 6E) to reach again the position illustrated in Figure 6A,

space E becomes space F and during the next cycle of operations the fluid, now occupying space F, is expelled through the outlet port 8 as space F diminishes.

During the cycle of operations, the hinge connection between the plate 6 and the cylinder 1 permits the plate 6 to hinge out of and into the recess 13 and the joint 9 allows the sleeve 5 to progress in an orbit dictated by the rotating eccentric 4. The eccentric 4 is free to rotate within the sleeve 5, the latter thus being able to provide in effect a good sliding connection between the piston and the plate 6 whilst making possible a non-flexible connection between the piston and the cylinder 1.

Referring again to Figure 6, it will be seen that movement of the piston from its position in Figure 6D to its position in Figure 6E effects no work, as during this period fluid can move freely between the inlet and outlet ports. It is therefore essential that a non-return valve be provided, preferably on the delivery side when the machine is used as a pressure pump, or on the inlet side when the machine is used as a suction or vacuum pump.

It will be seen that there is disclosed herein a positively located rigid connecting abutment plate disposed between the piston and the cylinder. It will also be seen that there is disclosed herein a positively located pivot for the connecting abutment plate, which will allow maximum displacement between cylinder and piston, and yet resist the forces set up by the rapidly moving piston, and so by combining large displacement per revolution with high speed operation, gain large volume displacement in relation to the size of the machine together with an acceptable volumetric efficiency.

The machine as disclosed herein can be used as a fluid or gas pump, or as a fluid or gas motor, and it is feasible that with suitable valve gear and cooling facilities that a twin cylinder unit can be adapted to function as an internal combustion engine or external combustion heat engine.

WHAT I CLAIM IS:—

1. A rotary-piston machine of the hinged abutment type, comprising a hollow cylinder having an internal wall and being closed at each of its ends by an end plate, a rotary-piston having a lesser diameter than the internal wall diameter of the cylinder and being eccentrically mounted about the longitudinal axis of the cylinder, a connecting abutment plate extending between said cylinder wall and the piston and further extending substantially the distance between the end plates, and means for hingedly connecting said abutment plate to the piston and to the end plates, the arrangement being such that, during operation, the piston and said abutment plate will provide separation of the space within the cylinder into a first zone communicating wtih an inlet to the machine and a second zone communicating with an outlet from the machine, the first zone, during operation, increasing in volume while the second zone decreases in volume, and the arrangement further being such that, during operation, fluid introduced into the first zone through the inlet will be received by the second zone from which second zone the fluid will be discharged through the outlet while the first zone increases in volume and the second zone decreases in volume.

2. A rotary-piston machine according to claim 1, wherein the hinge means connecting said abutment plate to the piston comprises a knuckle joint.

3. A rotary-piston machine according to claim 1 or claim 2, wherein the hinge means connecting said abutment plate to the end plates comprises a bearing in each of the end plates, each bearing receiving a pivot pin portion.

4. A rotary-piston machine according to any one of the preceding claims, wherein the piston comprises an eccentric disposed within a sleeve, the eccentric being capable of freely rotating within the sleeve.

5. A rotary-piston machine according to any one of the preceding claims, wherein the cylinder is recessed to accommodate said abutment plate whereby said abutment plate can hinge into the recess out of the path of the piston.

6. A rotary-piston machine according to any one of the preceding claims, wherein the piston is cylindrical except for a flat portion for engagement with a flat portion of said abutment plate.

7. A rotary-piston machine according to any one of claims 1 to 5, wherein the piston is cylindrical, and wherein said abutment plate has a portion for engagement by the piston, said portion being concaved on a radius substantially equal to the radius describing the inner peripheral surface of the cylinder.

8. A rotary-piston machine substantially as herein described with reference to the accompanying drawings.

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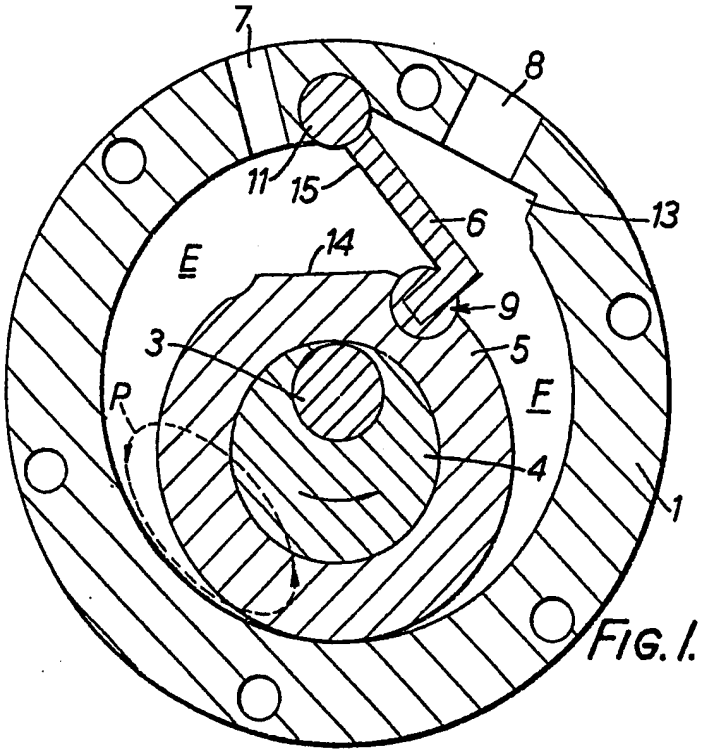


FIG. 1.

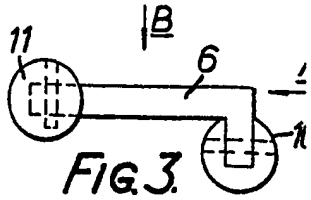


FIG. 3.

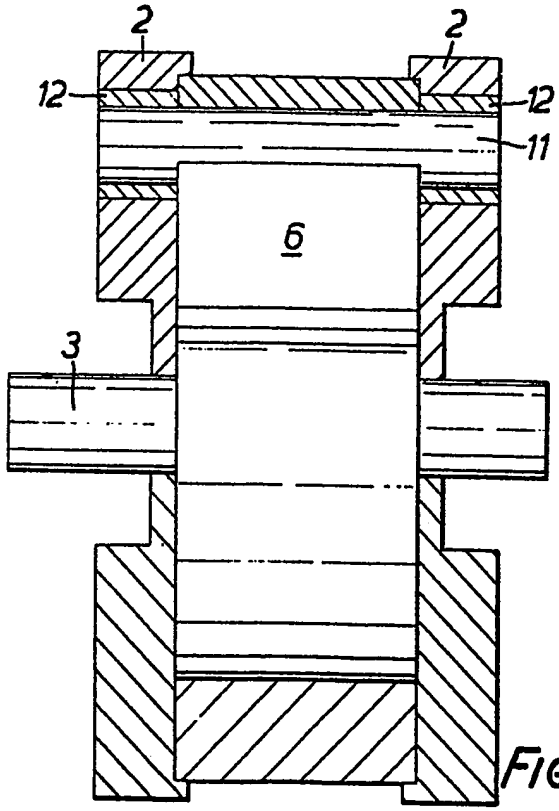
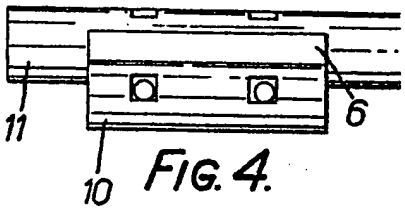


FIG. 2.



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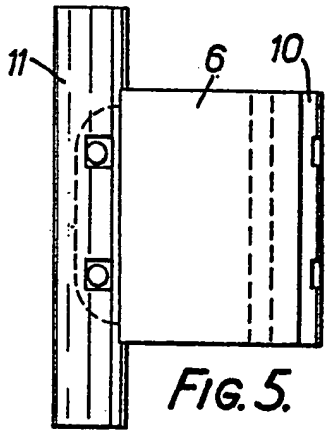

FIG. 5.

1,085,542 COMPLETE SPECIFICATION
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SHEETS 1 & 2

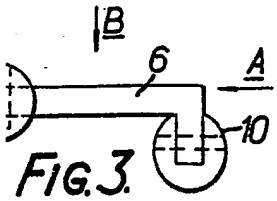
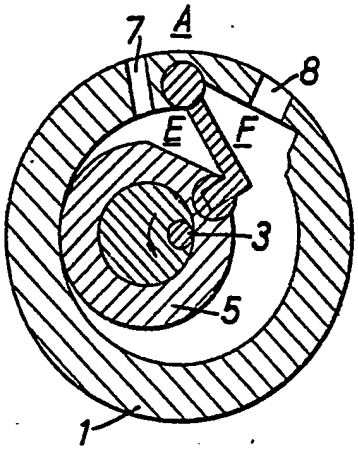
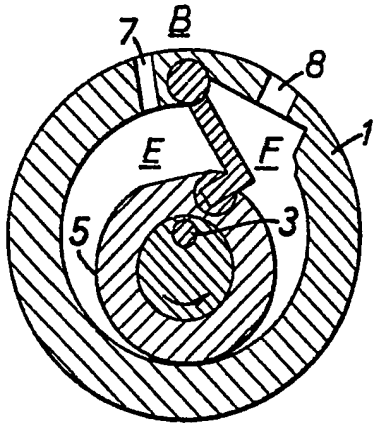


FIG. 3.





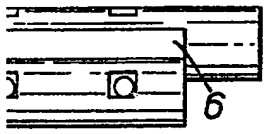
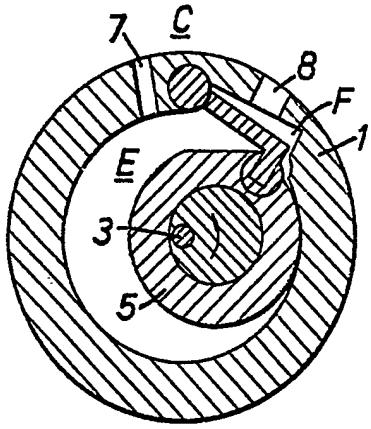
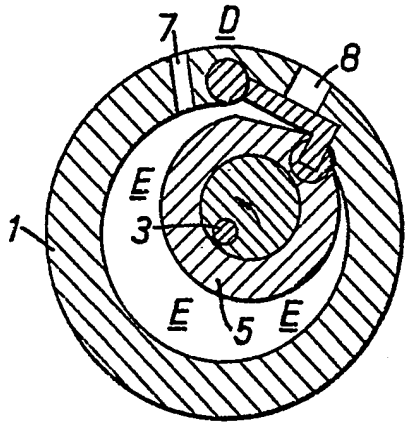


FIG. 4.





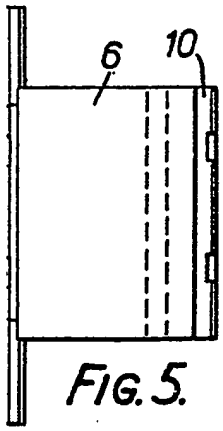


FIG. 5.

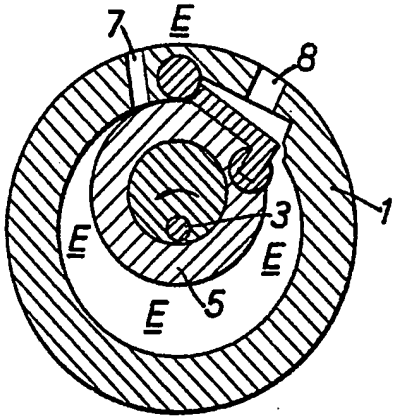


FIG. 6.

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SHEETS 1 & 2

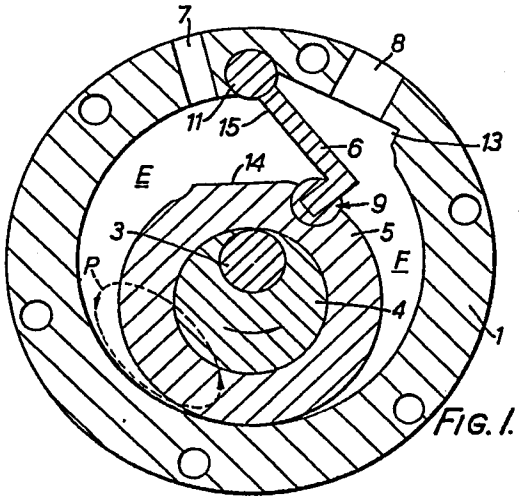


FIG. 1.

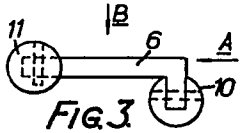
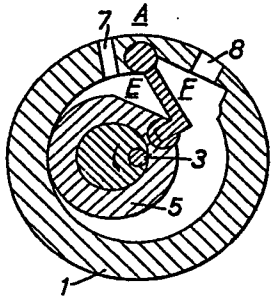
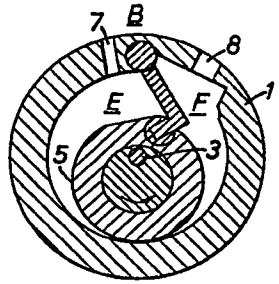
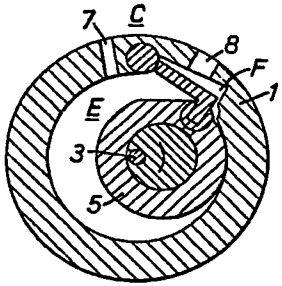
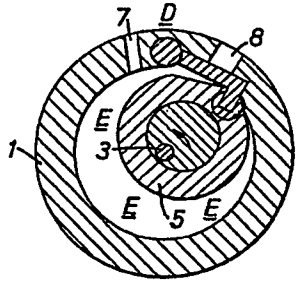


FIG. 3.









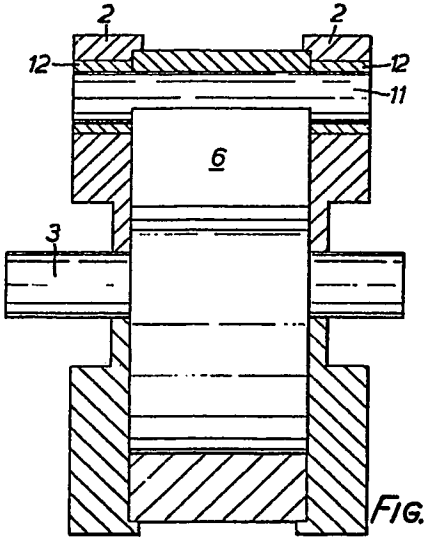


FIG. 2.

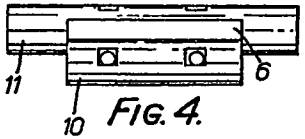
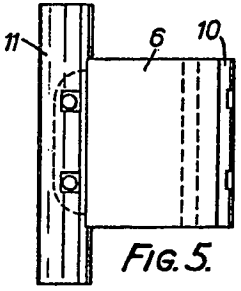


FIG. 4.



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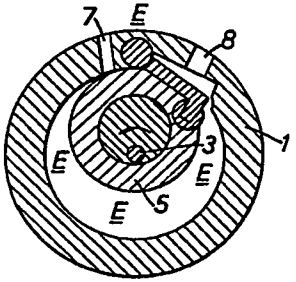

FIG. 6.